SVKM's
D. J. Sanghvi College of Engineering

Program: B.Tech in Computer Engineering **Academic Year: 2022** **Duration: 3 hours**
Date: 19.01.2023
Time: 09:00 am to 12:00 pm
Subject: Engineering Mathematics -III (Semester III) **Marks: 75**

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover page of the Answer Book, which is provided for their use.

(1) This question paper contains two pages.
(2) All Questions are Compulsory.
(3) All questions carry equal marks.
(4) Answer to each new question is to be started on a fresh page.
(5) Figures in the brackets on the right indicate full marks.
(6) Assume suitable data wherever required but justify it.
(7) Draw the neat, labelled diagrams, wherever necessary.

Question No.	Questions	Max Marks
Q.1.(a)	Find Laplace transform of $\sinh(t)\int_0^t e^{2u}\cosh(u)du$.	**(7)**
	OR	
Q.1.(a)	Evaluate by using Laplace transform $\int_0^\infty e^{-t}(1+2t-3t^2+4t^3)H(t-2)dt$.	**(7)**
Q.1.(b)	Solve using Laplace transform $\frac{d^2y}{dt^2}+9y=18t$ given that y (0) = 0 and y(π/2) = 0.	**(8)**
Q.2.(a)	Find the Z- transform of $\{\cos\left(\frac{k\pi}{8}+\alpha\right)\}$.	**(7)**
	OR	
Q.2.(a)	Find the inverse Z- transform of $\frac{1}{(z-3)(z-2)}$, i) $\lvert z\rvert < 2$ ii) $2 < \lvert z\rvert < 3$ iii) $\lvert z\rvert > 3$.	**(7)**
Q.2.(b)	Find inverse Laplace transform of $\frac{(s+3)^2}{(s^2+6s+5)^2}$ by convolution theorem.	**(8)**
Q.3.(a)	Find the Fourier series expansion for $f(x)=\sqrt{1-\cos(x)}$ in (0 ,2π).	**(7)**
	OR	
Q.3.(a)	Obtain half rang cosine series for $f(x)=\begin{cases} kx & 0<x<(\frac{1}{2}) \\ k(l-x) & (\frac{l}{2})<x<l \end{cases}$	**(7)**

Q.3.(b)	Obtain the complex form of Fourier series for $f(x) = \cosh(2x) + \sinh(2x)$ in $(-2, 2)$.	**(8)**
Q.4.(a)	Show that the set of functions $\{\sin\left(\frac{\pi x}{2L}\right), \sin\left(\frac{3\pi x}{2L}\right), \sin\left(\frac{5\pi x}{2L}\right), - - --\}$ is orthogonal over $(0, L)$ Hence Construct corresponding orthonormal set.	**(7)**
	OR	
Q.4.(a)	Express the function $f(x) = \begin{cases} 1 & \lvert x\rvert < 1 \\ 0 & \lvert x\rvert \geq 1 \end{cases}$ as a Fourier integral and Hence evaluate $\int_0^\infty \frac{\sin(\lambda)\cos(\lambda x)}{\lambda} d\lambda$.	**(7)**
Q.4.(b)	1) Find the Fourier Sine Transforms of $f(x) = e^{-ax}, a > 0$. 2) Find the finite Fourier Sine Transforms of $f(x) = x^2$, $0 < x < 4$.	**(8)**
Q.5.(a)	Find the Fourier Transform of $f(x) = \begin{cases} 1 & \lvert x\rvert < a \\ 0 & \lvert x\rvert \geq a \end{cases}$ where a is a positive real number. Hence deduce that $\int_0^\infty \frac{\sin t}{t} dt = \frac{\pi}{2}$	**(7)**
	OR	
Q.5.(a)	Find the Fourier Transform of $e^{-a^2x^2}$ and hence find the Fourier Transform of $\cos\left(\frac{x^2}{2}\right)$ and $\sin\left(\frac{x^2}{2}\right)$.	**(7)**
Q.5.(b)	If $f(x) = e^{-ax}, a > 0$ then find the Fourier Cosine Transform and hence using Parseval's identity evaluate $\int_0^\infty \frac{dx}{(x^2+a^2)^2}$, $a > 0$.	**(8)**

All the Best!